



INTRODUCTION

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Given our recent experiences with AIDS, tuberculosis (TB), and antibiotic-resistant bacteria, few would doubt this is a very important topic or that infectious diseases will be an increasing health problem in the future. The outbreak of Ebola virus infection in Zaire is yet one more example of the ever-present threat of infectious diseases and should remind us of the importance of this topic, if we have forgotten. One hoped-for result of this conference is that it will spur collaborations between different disciplines, with the aim of understanding and responding better to the threat of emerging infectious diseases.

With Dr. Barondess, I also thought that a comment from René Dubos would be an appropriate way to start the conference. In his 1965 book, *Man Adapting*, he made the following observation: "Most clinicians, public health officers, epidemiologists, and microbiologists felt justified in proclaiming that the conquest of infectious diseases had finally been achieved."¹ Most of the infectious diseases that were likely to exist had been described; effective treatments and preventive measures, such as immunizations or the eradication of the pathogens or their vectors, seemed at hand. Notable successes had been achieved: new antibiotics were developed; we were able to eradicate smallpox, and the Salk and Sabin vaccines were developed. There were notable disappointments as well, such as the efforts to eradicate malaria. After stunning initial successes, the efforts failed for two reasons: the resources for control dried up just before eradication was completed, and mosquitoes became resistant to insecticides. The optimistic view that Dubos had presented failed to take into account, as Dubos said, the adaptability of microorganisms and complexity of the relationships between man and his environment.

In the time since Dubos wrote, we have seen an explosion of previously

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unrecognized infectious diseases. We might consider four varieties of emerging infectious diseases.

First, we can think of new, previously unrecognized diseases that have appeared suddenly. Obvious examples are AIDS, Hantavirus pulmonary syndrome, Legionnaires' disease, and hemorrhagic fevers like Ebola virus. These diseases raise compelling questions for us. For instance, what are their reservoirs in nature? Do they come from jungles, wildlife, sewers, air-conditioning ducts? What is the inventory of potential pathogens extant? What genetic mutations or recombinations preceded their emergence? What selective forces exist? How do these forces operate to select these pathogens? Are they the unanticipated consequence of economic development, changes in housing, and land-use patterns? One of the statements about the AIDS epidemic was that the single most important fact in the emergence of the epidemic was paving the road to Mombasa.

Can we identify these pathogens? Have we identified new, vulnerable host populations? Are our surveillance and reporting systems adequate? Do they have the ability to recognize the pathogens, evaluate their significance, and respond? Could the new infections be anticipated?

The second factor is that "new" etiologies have been established for known diseases. One of the most amazing examples is the revolutionary finding that peptic ulcer disease is caused by *Helicobacter pylori*. This common affliction has become treatable with antibiotics and potentially preventable by avoiding infection. Since *Helicobacter* has a role in gastric cancers and lymphomas, we can think about preventing these, too. Clinicians would not have dreamed of this 15 years ago.

The third factor in the emergence of infectious diseases is that the incidence of these diseases surges and ebbs. This ebb and flow recently has been seen in streptococcal infections, TB, and, of course, the infectious complications of HIV. The detailed reasons for this ebb and flow may provide clues to prevent, diagnose, and treat these diseases.

In the case of resurgent TB, AIDS and immigration were important factors, but certainly in New York City the most important factor was the breakdown of the public health system that had been in place to care for patients with TB.

Finally, medical progress is associated with changing patterns of infectious diseases. Examples include antibiotic-resistant bacteria and nosocomial infections.

The specter of hospital beds filled with patients suffering from infectious diseases such as pneumococcal pneumonia and bacterial endocarditis, which

have become untreatable because of antibiotic resistance, has been raised. The emergence of antibiotic resistance is an important focus of this conference.

The conference also covers the mechanisms for emergence; that is, the biologic, environmental, and host determinants of emerging infections. Investigators need to identify an inventory of potential sources of new pathogens. Conference presenters will discuss the basis of biologic variation and try to increase our understanding about how things like ecological, social, behavioral, political, medical, technical, and host factors all combine and conspire to let new pathogens emerge.

The conferees will assess the resources for responding to emerging infections and identified areas that need improvement. It is clear that, in the future, we are going to need to have prepared clinicians, clinical diagnostic laboratories, public health officials, reference laboratories, and reporting systems in place; we need to assess them now. We need to consider the potential impact of projected changes in financing and delivery of health care. Will managed-care systems, whose goal is cost cutting, be able to provide support for clinicians to make specific microbiologic diagnoses, and will they provide and encourage reporting? Certainly it is possible, because of their emphasis on data management, that they will encourage reporting of infectious diseases. This could be a positive aspect of health care reform and managed-care organizations. We have to consider the impact of block-grant funding for city health departments.

As a result of the conference, I hope that we will become better able to anticipate the emergence of infectious diseases. I propose that we move toward a science of epidemic forecasting. I would like to encourage collaborations between all the different diverse disciplines that came together at this conference; in the collaborations could try to predict when, where, and how infectious diseases may emerge. Even if we cannot forecast accurately now, we may attain a better understanding of emerging infections through collaborations.

We must work to increase the sophistication and sense of responsibility about infectious diseases. We have to do this with the general public. We have to do this with clinicians, who need to be encouraged to make specific etiologic diagnoses and to participate in reporting.

People concerned about cost containment, such as politicians, managed-care organizations, and health administrators, need to be aware of how important emerging infectious diseases are and need to be encouraged or mandated to support their study.

Finally, we need to be concerned about proposals to cut back federal support for basic research. Many of the answers to new infectious diseases will come

from basic scientific investigations. Federal funding has produced some of the greatest scientific advances in history. We certainly have lived in a golden age: in molecular biology, cosmology, space exploration, geology, and medicine, tremendous advances have been made in the past 50 years. Much of our progress as a people has occurred because of open, federally supported research. When we consider the threat of emerging infectious disease and the research that will be needed to combat the threat, we might ask, justifiably, How can we possibly give that up?

REFERENCE

1. Dubos R. *Man Adapting*. New Haven: Yale University Press; 1965.